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Study on Helminth Parasites in Tilapia nilotica from Lake Zeway, Ethiopia

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Abstract
A cross sectional study was conducted in Lake Zeway on helminth parasites in *Tilapia nilotica* to determine the infection rate of helminth parasites. Gillnets were set in the evenings and retrieved in the mornings and fish were randomly sampled in fish production and marketing industry that were brought from different angles of the lake. The mesentery and the gastrointestinal tract were carefully separated and examined. Out of 400 specimens, 277 were examined 277(69.25%) infected with *Clinostomum* species. Metacercariae were found in the mesentery, and gastrointestinal tract, the brachial cavity, between the pharyngeal teeth and ventral side of cranium, and muscle. Immature and adult cestodes of the genus *Bothriocephalus* were found in the lumen of intestines with the proportion of (43)10.75% and (6)1.5% respectively of the diagnosed samples of fish 49(12.25%). Comprehensive information on existing fish parasites in Ethiopia and their epidemiological aspects is scanty. However, to decrease the infestation rate and break the life cycle of the parasite, proper waste disposal system and sanitation measures must be implemented.
Keywords: Bothriocephalus, Clinostomum, Helminth Parasites, Lake Zeway and Tilapia nilotica.

1. Introduction

More than 200 species of fish are known to exist in lakes, rivers and reservoirs in Ethiopia (EARO, 2000). Ethiopia is a land locked country, thus depends on its inland water bodies for fish supply to its population. The country's major lakes and reservoirs cover an estimated surface area of 7,334 km^2 whereas small water bodies cover 275km^2. The main rivers flow 7,185km inside the country (MOA, 2002). Despite the presence of huge volume of water bodies in the country, its contribution to the national economy is marginal. This is mainly due to man-made and environmental constraints (Amare, 1986).

Ethiopia has extensive potential sources of protein of animal origin from its considerable large livestock and fish population, the best opportunity nature provides (Temesgen, 2003). Despite the availability of huge potential for fish production, the country has an annual per capita consumption of 240g per person, the lowest in Africa. However, 10 kg per person per year was achieved in areas where there is regular and sufficient supply of fish (EARO, 2000; MOA, 2002).

The country has an estimated total exploitable fish potential of 51,481 tons per year, which can only meet 79% of the current actual demand and 55% of the projected demand in 2010 and 44% in 2015, only considering population factor. In view of this, the present water bodies or fish supply sources are unable to meet demand at all time. However, important constraints remain to be addressed to realize the opportunity (MOA, 2002).

Parasitic diseases reduce fish production by affecting the normal physiology of fish and if left uncontrolled can result in mass mortalities, or in some cases, can be serve as source of infection for human and other vertebrates that consumed fish (Ayotunde *et al.,* 2007).

Understanding the etiology of parasitic diseases is of crucial importance as it determines the choice of a potential treatment. Hence, identification of parasites to the genus level is generally sufficient to implement an effective therapeutic or prophylactic strategy. However, the presence of a massive number of parasites on each fish might constitute a real threat to the fish population and should require immediate action (Komar and Wondover, 2007). A considerable amount of information is available worldwide on the helminth fauna of freshwater fish, especially in Europe, Russia and United States of America but incentives for comparable studies in Africa are lacking. Most studies on African fish parasites have been carried out in western, central and southern Africa, whereas literature from Eastern and Northern Africa is scanty due to lack of experienced personnel in fish parasitology (Aloo, 2002). Although literature is replete with information on helminths of temperate fish, little information exists on those of tropical fish (Olurin and Somorin, 2006).

Therefore, the objective of this preliminary study was to determine the current infection rate of helminth parasites of *Tilapia nilotica* in Lake Zeway.

2. Materials and Methods

2.1. Study Area

The study was conducted in Lake Zeway, East Shewa Zone of Oromiya Regional State located 160 km south of Addis Ababa, one of the most indigenous fish population of the Ethiopian lakes. The lake is located 8^0 N and 38^0 40 'E at an altitude of 1840 m above sea level. The lake covers an area of 434 km^2 and its average depth is 2.4m and 25 km long and 20 km wide (Eshetu, 2000). The average annual rainfall of the area is about 688 mm and its mean maximum and minimum temperatures are 27.2^0C and 14.4^0C respectively. It has 55% mean relative humidity and wind speed 1.66 m/second (Tugie and Taye, 2004). The major fish species in the lake include *Tilapia, Barbus*, Catfish and Carp species (Eshetu, 2000).

2.2. Sampling Methodology

Fish that were caught by the local fishermen from different angles of the lake and brought to the Fish Production and Marketing Industry were randomly sampled. The fish were captured by the fishermen using gillnets of mesh sizes 60-120 mm. Fish samples were collected and kept in icebox and immediately transported to the laboratory of Aklilu Lemma Institute of Pathobiology (ALIPB) where they were examined for helminth parasites.

2.3. Parasitological Procedure

A total of 400 fish were collected from Lake Zeway and examined for the presence of helminth parasites during the study period. Grossly, each fish specimen was carefully examined for conditions suggestive of parasitic infection before opening for detailed examination**.** Fish were dissected and examined for metacercariae on the muscles and visceral organs. The gastrointestinal tract was then opened and examined internally for helminth parasites using the technique described by Gichohi *et al*., (2008). The Metacercariae of *Clinostomum* from fish were released manually from their cysts before were fixed for identification using the techniques described by Paperna and Schmidt (1980).

2.4. Data analysis

Proportions and simple descriptive statistics was used for data analysis.

3. Results

Out of 400 specimens examined, 277 (69.25 %) were infected with metacercariae of *Clinostomum* species that were located in the mesentery and gastrointestinal tract brachial cavity, between the pharyngeal teeth and ventral side of cranium, stomach, intestines and muscle. Cestodes of the genus *Bothriocephalus* were found in the lumen of intestines at a rate of 49(12.25%) of the examined samples. Of these (43)10.75% were immature stages and (6)1.5% adults (Table 1 and 2).

Table1: Prevalence of *Clinostomum* and *Bothriocephalus* species in *Tilapia nilotica* in Lake Zeway

Name of Parasite	No. Examined	No. Positive	Prevalence
***Clinostomum* species**	400	277	69.3
***Bothriocephalus* species**	400	49	12.25

Table2: Prevalence of Bothriocephalus species in *Tilapia nilotica* in Lake Zeway

Bothriocephalus species	No. Examined	No. Positive	Prevalence
Immature stage	400	43	10.75
Adults	400	6	1.5
Total	400	49	12.25

4. Discussion

There are various reports on the prevalence and intensity of parasites infecting freshwater fish in Africa (Paperna and Schmidt, 1980). The helminth larval parasites belonging to genera *Clinostomum* species are known to occur in most African freshwater fish (Tedla and Tadesse, 1979; Paperna and Schmidt, 1980). In Lake Awassa Temesgen (2003) found both larger and smaller *Clinostomum* metacercaria with prevalence rate of 75.67% and 11%33% respectively in *Oreochromis niloticus* from Lake Awassa. Moreover, the prevalence rates of metacercariae of *Clinostomum* from Lake Zeway in *Tilapia nilotica* were 9.09% (Eshetu, 2000) and 9.86% (Wudneh, 1996). In Lake Tana Gebeyehu (2003) and Tefera (1990) reported metacercaria of *Clinostomum* with prevalence rate of 60.98% and 74.32% respectively. Amare (1986) recorded *Clinostomum* species in Lakes Awassa and Chamo with prevalence rate of 63.2%.

However, the finding of the present study was higher than the 9.86% prevalence reported by Wudneh (1996) and the 9.09% prevalence reported by Eshetu (2000). The difference could be due to the longtime interval between the previous studies and the dynamic nature of intermediate host (snail) and the presence of large

population of snails and aquatic birds around the lake that harbor adult parasites. In addition, this might also be due to the effect of pollutants that arise from floriculture near the lake and disposal of fish offal into the lake. Fish in polluted waters tend to harbor more endoparasites than those from less polluted environments (Aloo *et al.,* 2004).

Results reported by Malek and Mobedi (2001), the prevalence of *Clinostomum complanatum* in medium sized *Capoeta capoeta gracillis* from Shiroud River was 60% in Iran. In Kenya, the prevalence of *Clinostomum metacercaria* in *Oreochromis leucostictus* was 6.4% from Lake Naivasha and Oloidien Bay (Aloo, 2002). In Nigeria, Ayotunde (2007) have reported *Clinostomum* species in the stomach and muscle of Labeo coubie in the Coss River with prevalence rate of 15.8% whereas Olulin and Somorin (2006) have reported that *Clinostomum tilapiae* in *Tilapia mariae* with prevalence rate of 71.43% from Owa stream. Therefore, the finding of the present study is consistent with the findings of Malek and Mobedi (2001) and Olulin and Somorin (2006) but relatively higher than the results of Aloo (2002) and Ayotunde (2007).

Amare (1986) reported that 6.5% of *Barbus* species were infested with adult *Bothriocephalus aegipticus* in Lake Awassa. Eshetu (2000) and Temesgen (2003) reported that 1.33% of *Clarias garpinus* in Lake Zeway and 35% *Barbus* species in Lake Awassa were infected with *Bothriocephalus* species respectively. The present study in Lake Zeway revealed that 44 (11%) of *Tilapia nilotica* were infected with 43 (10.75%) immature stage and 6(1.5%) adult *Bothriocephalus* species. This is in agreement with studies by Amare (1986) and Eshetu (2000) but lower than that of 35% Temesgen (2003). The lower prevalence rate as compared with Temesgen (2003) might be due to difference in fish species and variation in temperature as low temperature interrupts development and completion of the parasite life cycle (Paperna, 1980). The presence of low level of population of intermediate hosts of cestode parasites along the shore and in the Lake and the feeding behavior of *Tilapia nilotica* can also influence the prevalence.

Hoffman (1983) reported that worms accumulate in the anterior intestine, which becomes obstructed or perforated resulting in high mortalities. One of the most serious adult cestodes that affect fish is the Asian tapeworm, *Bothriocephalus acheilognathi*, having an unusually wide host range. It can cause up to 90% mortality in grass carp and juvenile common carp. *Bothriocephalus acheilognathi* must be considered one of the most freshwater fish parasites. Its principal host, *Cyprinus carpio*, is arguably the world's widespread freshwater fish as a result of its distribution for aquaculture; sport and weed control and has prevalence of 25.5% in *Cyprinus carpio* in Australia (Dove and Fletcher, 2000). These findings are incomparable with the present study due to geographical and environmental factors and low level of intermediate hosts.

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6. Conclusion

Comprehensive information on existing fish parasites in Ethiopia and their epidemiological aspects is hardly available. The present study showed that the proportion of *Clinostomum* species was high. Therefore, to increase the fishery potential sound and comprehensive knowledge of the biology of the host parasite system within the context of the ecology of habitat should take into account in the role of fish parasites in fish production in order to achieve optimal results. Proper waste and offals disposal system should be introduced and implemented to avoid and break the parasite life cycle between predator birds. Adoption of relevant environmental management measures like clearing of vegetation from the shores of lakes, reservoirs and ponds to control the intermediate host snail population. An effective parasite control program should be incorporated in management procedures of major lakes.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper

Authors' contributions

Temesgen conducted the actual study and the statistical analysis. Temesgen and Getachew were involved in developing the idea and designing of the study. Both authors were also involved in the write up of the manuscript. All authors approved the submitted version of the manuscript.

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